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PHYSICAL ACTIVITY LEVEL AMONG HEALTH STUDENTS

A comparative study between Australia and Sweden

Authors

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Abstrakt

Examensarbete:	15 hp
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Handledare:	Eva Holmgren, Medecine Doktor, Leg. Fysioterapeut
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Bakgrund:	Idag inträffar ungefär 3,2 miljoner dödsfall varje år på grund av otillräcklig fysisk aktivitet. Fysisk aktivitet utöver WHO: s rekommendationer bidrar till att minska risken för viktökning och sjukdom.
Syfte:	Undersöka och beskriva den fysiska aktivitets- och inaktivitetsnivån, både skriftligt och statistiskt, av hälsostudenter vid Griffith University, i Australien. Resultaten kommer sedan att jämföras med en tidigare utförd studie på hälsostudenter vid Göteborgs universitet.
Metod:	Urvalet gjordes via ett icke-slumpmässigt urval. IPAQ användes i kombination med egenutformade komplementära frågor. Deltagarna var hälsostudenter vid Griffith University. Det totala antalet användbara frågeformulär var 91 (32 kvinnor, 59 män) och de studerade antingen fysioterapi (n = 23) eller träningsvetenskap (n = 68). Oberoende t-test användes vid beräkning av signifikans. Signifikansen definierades till $p<0.05$.
Resultat:	Griffith University hade överlag högre MET-minuter / vecka. Vid Griffith University uppnådde deltagarna sin högsta andel av MET-minuter/ vecka från ”arbetssektionen”, 41%. Vid Göteborgs universitet var motsvarande högsta andel från “fritidssektionen”, 57,6%. Deltagarna som svarade "nej" på frågan om de är fysiskt aktiva faktiskt kategoriseras i IPAQ-kriterierna "hög" och "moderat" baserat på deras MET.
Konklusion:	Griffith University hade hög fysisk aktivitet men spenderade mycket tid i passiv transport och sittandes. Vid jämförelse av universiteten kunde endast en betydande skillnad ses i IPAQ-formulärets sektion "arbete" ($p <0,0001$). Ingen större skillnad i fördelningen mellan deltagarna som hamnar under IPAQ-kategorierna “hög”, “moderat” och “låg” sågs mellan universiteten. Det är mycket viktigt att informera allmänheten om konsekvenserna och prevalensen av fysisk inaktivitet och NCD-sjukdomarna.

Abstract

Bachelor thesis:	15 hp
Program:	Physical therapist
Level:	Bachelor
Term/year:	6/ 2018
Supervisor:	Eva Holmgren, Ph.D, RPT
Examiner:	Roland Thomeé, Prof. RPT
Key words:	Physical activity, inactivity, physiotherapy, sedentary behavior, IPAQ.

Background:	Today, approximately 3.2 million deaths each year occur due to inadequate physical activity. Physical activity in addition to the WHO recommendations contribute in reducing the risk of weight gain and disease.
Aim:	Investigate and describe the physical activity and inactivity level, both in writing and statistically, of health-students at Griffith University, in Australia. This will then be compared with a previous study conducted in health programme-students at the University of Gothenburg.
Methods:	The selection was made by a nonprobability sampling. IPAQ was used in combination with complementary questions. The study population were health students at Griffith University. The total number of useful questionnaires was 91 (32 women, 59 men) studying physiotherapy (n=23) or exercise science (n=68). Significance level was defined as $p < 0.05$.
Results:	Griffith University had higher MET-minutes / week. At Griffith University, participants achieved their highest MET-minutes / week in work section, 41% and at the University of Gothenburg in leisure time section, 57,6%. Participants who answered “no” to the question whether they are physically active actually were categorized into the IPAQ criteria “high” and “moderate”.
Conclusion:	Griffith University had a high physical activity but spent much time in passive transportation and being sedentary. When comparing the two universities regarding the different sections of IPAQ, only in the "work" section a significant difference was noticed ($p<0.0001$. No major differences in the distribution between the “high”, “moderate” and “low” IPAQ categories were observed between the two universities. It is of great importance to inform the public about the consequences of physical inactivity and NCD diseases.

Background

According to the World Health organization (WHO), globally, approximately a third of all adults over 15 years of age were insufficiently physically active in 2008. Approximately 3.2 million deaths each year occur due to inadequate physical activity. The high level of physical inactivity is partly due to inadequate participation in physical activity during leisure time. Urbanization has led to changed environmental factors, which work against physical activity, for example; passive types of transportation and lack of sidewalks, parks and sports facilities, as well as increased violence in society (1).

A large study from Australia has shown large effects of sedentary behaviours. The longer these behaviours were performed, the more likely the individual has a higher prevalence of metabolic syndrome, microalbuminuria and hypertension. It has also been shown that those who lived up to or exercised more than the WHO recommendations for physical activity were conversely associated with reduced prevalence of metabolic syndrome. In addition, the study showed that regardless of physical activity level, the longer time spent sedentary, the greater the risk of developing metabolic syndrome (2).

WHO states; "Body Mass Index (BMI) is a simple index of weight-for-height that is commonly used to classify underweight, overweight and obesity in adults. It is defined as the weight in kilograms divided by the square of the height in metres (kg/m^2)." International classification of underweight, overweight and obesity is <18.5;>=25.00 and >=30.00kg/m2. Normal range is between 18.50-24.99 kg/m2 (3).

In 2008, 20% of the men and women in Australia could be placed under the category of obese. Same year, raised blood pressure was found in 25% of men and 20% of women. About 25% of the total Australian population were obese and 20% suffered from raised blood pressure (4). In Sweden, the corresponding numbers from the same year, 2008, are slightly lower for obesity; 20% of both the men and the women and slightly less than 20% of the total Swedish population. Raised blood pressure was found in approximately 30% of men and 25% of women and a total of approximately 30% of the total population in Sweden (5).

Obesity including its severe variety has become one of the major health problems in the 21st century (6). These conditions affect both adults, children and teenagers. The prevalence of obesity and severe obesity is high in both developing countries and industrialized countries (7). These conditions affect quality of life and are major risk factors for developing heart disease due to high blood pressure, high blood fats and insulin resistance (8). Mental health problems

are, as well, a major cause of disease burden in the world. Severe depression has been shown to be the second leading cause, worldwide, to disability and a major contributor to ischemic heart disease and suicide (9).

Noncommunicable diseases (NCDs) have increased during the 2000s (10). The diseases can be related to unhealthy lifestyles, such as smoking, physical inactivity, unhealthy diet and alcohol. The environment, economic status and background also play a role in premature death (11). WHO has selected certain factors to focus on in order to reach out to countries and reduce NCDs, one of these factors is drawing attention to the negative effects of physical inactivity (10). The total number of deaths in Australia year 2014, were estimated to 147,000, of which 91% are due to NCDs (4). The total number of deaths in Sweden the same year were estimated to 91,000, of which 90% are due to NCDs (5).

Non-communicable diseases, are now the global leading cause of premature death and physical inactivity is the fourth largest contributor to NCDs. There is strong evidence that physical activity, both directly and indirectly, prevents many NCDs (12). Physical inactivity and sedentary behaviours for long periods have a high correlation with NCD (13).

Physical activity is defined as "any bodily movement produced by skeletal muscles that requires energy expenditure" (14). Activities can be measured in Metabolic Equivalent of Task (MET), where 1 MET estimates the amount of oxygen consumed at rest, lying or sitting, approximately 3.5 ml O^2/kg/min which is 1.2 kcal/min for a 70-kg person. (15).

The recommendations for physical activity for adults, according to the WHO are a minimum of 150 minutes of moderate intensity physical activity (3-6 MET) a week for people aged 18-65 years. All of these recommendations are seen as a minimum to maintain and increase health. 30 minutes of moderate intensity five days a week is equivalent to a minimum 600 METs per week. Physical activity in addition to the recommendations also contribute in reducing the risk of weight gain and disease. For additional health benefits according to WHO, the activities at moderate activity level should be increased to a minimum of 300 minutes per week or a minimum of 150 minutes of vigorous activities a week. The recommendations for additional health benefits is equivalent to a minimum of 1200 METs per week.

Physical activity at a moderate level may be, for example, activities such as a brisk walk of 30 minutes, or splitting the walk into three episodes of at least 10 minutes. Vigorous intensity

should be of such intensity causing your heart rate to increase enough to cause heavy breathing, for example running. An addition to the recommendations above, the maintenance of muscle strength is also recommended, the ACSM recommends 8-10 exercises twice a week (16, 17, 18). Physical activity and exercise lead to many health benefits and has been shown to reduce the risk of developing cardiovascular disease, stroke, type II diabetes and cancer (19). Physical activity can have a positive effect in combination with medication in people with depression (20). Aerobic exercise combined with medication in patients having major depression has shown good results and can be used in treating patients for this type of depression. Physiotherapy, in general, has a good effect as a treatment for patients suffering from major depression (21). It is clear that physical activity, especially strength training prevents breakdown of bone mass during the aging process and significantly reduces the fracture incidence (22).

Exercise prescription, is something that physiotherapists have the right to prescribe and teach inactive patients, in both Australia and Sweden, and is an important part in advocating physical activity and thereby reduce the risk of lifestyle diseases. Physical activity on prescription is personalized and used in several countries as a tool trying to get patients to become more physically active and thus reduce the risk factors of lifestyle diseases (23). With individualized physical activity on prescription evidence has shown a significant increase in self-reported physical activity and also the quality of life (24).

The professional physiotherapist role is to help people prevent diseases, injuries and to rehabilitate and strengthen their overall health. The profession also guides the patient to find ways of staying physically active in daily life and individualizes all training programmes. The individually tailored activities, can be seen as both health promoting and as rehabilitation (25).

Physical inactivity is a growing problem worldwide. Students spend a lot time studying, whether it is in school or at home, it is often associated with much time spent sedentary and being physically inactive. Therefore, it is of great value to have knowledge about students' physical activity level.

The purpose of this work is to investigate and describe the physical activity and inactivity level, both in writing and statistically, of health students at Griffith University in Australia. This will then be compared with a previous study conducted in health programme-students at the University of Gothenburg.

Method

Study design

The study design was a cross-sectional design. Data were collected in March 2018 at the Griffith University in Australia, using a questionnaire.

Population

The selection was made by a nonprobability sampling, meaning that the selection was not randomized (26). Requests for participation were sent to multiple universities in Australia.
The study population in this study were all health students at Griffith university, Gold Coast.
Health-students in this study are defined as i.e. health-promotion students, biomedical analyst students, nursing students, exercise science students, medical students, dietician students and physiotherapy students.

Measurements

International physical activity questionnaire (IPAQ) is available in two different versions, one short version and one long version. The English version of IPAQ, The Long Last 7 Days Self-Administered Version of IPAQ, is more detailed and was chosen to be the main measurement in this study (28) (Appendix 2).
The validity of IPAQ is high since the frequency, intensity and time for physical activity is obtained and sedentary time can be collected. IPAQ have good results result from the self-reports of a correlation median of 0.8, indicating a good reliability. The longer form evaluates four domains of physical activity: work, transportation, housework and leisure. The time spent being sedentary is measured alone as a fifth domain. The score of the questionnaire is recommended to be measured in MET minutes per week and is calculated by: MET level * minutes of physical activity * activities per week (29).

The results of IPAQ are divided into 3 categories:

1. Low
    - No activity is reported OR
    - Some activity is reported but not enough to meet Categories 2 or 3.
2. Moderate

Either of the following 3 criteria

- 3 or more days of vigorous activity of at least 20 minutes per day OR
- 5 or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR
- 5 or more days of any combination of walking, moderate-intensity or vigorous intensity activities achieving a minimum of at least 600 MET-minutes/week.

3. High

Any one of the following 2 criteria

- Vigorous-intensity activity on at least 3 days and accumulating at least 1500 MET-minutes/week OR
- 7 or more days of any combination of walking, moderate- or vigorous-intensity activities accumulating at least 3000 MET-minutes/week (30).

A questionnaire with additional questions was used; “Complementary questions”, (Appendix 3), containing information about the participants' studying program, age, gender, weight, height, type of activity and the reasons for physical inactivity / activity. The complementary questions were selected to match previous completed studies and in case of compared with their results in the same field, as well as to compare between the various factors that were analysed (27). These questions were obligatory and there was no ability to leave questions blank, in order to collect as much data as possible.

Data collection

The data collection took place at two separate occasions, two weeks apart and the same procedures were used both times. The first distribution of questionnaires took place at the very first introduction week to students studying their first year. 150 people were present and there were 68 people participating via google forms and two people via hard copies. The second distribution of questionnaires was to students studying their third year. 71 people were present and there were 52 people participating via google forms and zero people via hard copies.
Inclusion criteria were; student at Griffith University, studying a health program and aged at least 18 years. These criteria were chosen to match the participants’ age and education with a former already completed study at the University of Gothenburg (27) and then to compare these results.

In case the participants did not see a benefit of participating, the two authors were present at the distribution and the collection of questionnaires to answer any questions. The participants received information regarding the survey verbally as well as in writing (Appendix 1). Participants were informed that participation is anonymous and voluntary, and if choosing not to participate, to submit the questionnaire leaving all answers blank. Both IPAQ and the complementary questions were submitted as either a hard copy or through a Google Forms link, which was anonymous as well. The authors brought an iPad-tablet in case of technological difficulties. Those who did not get the technology working or for any other reason preferred a hard copy received one of those instead of using the google forms link. A Google Forms-link reduces the risk for errors when putting in values, because data is directly exported to Excel, a data management program. The participants had to answer all questions to be able to complete the form when using the Google Forms-links, therefore no answers were left blank.

Since the hyperlink for google forms was long and difficult to type in, a website with a much easier hyperlink was created. On this website, the link for google forms was very pedagogically and easily shown and the participants only had to click on it to open the questionnaire. This link was locked with a password until the first data collection took place. Right before the data collection was about to begin, this link was unlocked and available for the participants. This was made in order for no one else to access the link and therefore minimize biases. The google forms link was changed to a new one just before the second data collection took place, in order to separate the two occasions.

The Google Forms-link was tested by six different individuals in forehand, which minimized the risk of errors and made sure the questionnaire was user friendly.

Statistical analysis

The answers from google forms were exported directly via a .csv file to excel where the results were controlled. The data where then processed, transferred and analysed using the Statistical Package for Social Science (SPSS). The complementary questions (Appendix 3) were analysed to identify differences and similarities in physical activity / inactivity regarding gender, age and BMI. When analysing the results at Griffith University, independent samples t-test was used

for calculating significance. When comparing the results between the universities, summary independent samples t-test was used for calculating significance. During calculation, significance level was defined as $p < 0.05$.

Results

A total of 221 students were present during the distribution of the questionnaires and 122 of these participated, 120 students via google forms and two students via hard copies. There were 31 intern lapses due to participants not corresponding to the criteria for IPAQ (30), which gave a total of 91 useful questionnaires for this study.

The participants studied either physiotherapy (n=23) or exercise science (n=68) at Griffith University. 92,3% of all participants choose the age alternative; ”18-25 years”.

Participants studying year 1 were 47, studying either physiotherapy (n=17) or exercise science (n=30) and year 3 were 44, studying either physiotherapy (n=6) or exercise science (n=38). Demographic details in table 1.

Table 1. Demographics

	Griffith University n=91	**Year 1 n=47**	**Year 3 n=44**
Sex (f/m)	32/59	16/31	16/28
Height (cm)	176 (SD ±8.77)	176 (SD ±8.98)	176 (SD ±8.65)
Weight (kg)	72 (SD ±13.9)	69.6 (SD ±11.8)	75.1 (SD ±15.70)
BMI (kg/m2)	23.2 (SD ±3.37)	22.3 (SD ±2.40)	24.1 (SD ±4.00)

The study at the University of Gothenburg included a total of 198 students, 154 females and 44 men. Mean BMI was 23,0 kg/m^2. At the University of Gothenburg all studied some kind of health program, either physiotherapy, nursing or biomedical science (27).

At Griffith university, the students were divided into; “high”, “moderate” and “low” according to IPAQ’s categories of physical activity. The number of students in the category high are 78%, the number of students in the category moderate are 21% and the number of students in the category low are 1%.

At the university of Gothenburg, the corresponding numbers were following; students in the category high are 51%, the number of students in the category moderate are 41% and the number of students in the category low are 8%.

I Physical activity and inactivity at Griffith University

A total of 82 students (90%) at Griffith University answered yes to the question "Are you physically active". The main reason for the students studying year 1 was "It is fun" and the main reason for students studying year 3 was "it is healthy". Details presented in table 2.

Table 2. Question 8: Why are you physically active?

	I have to	**It is healthy**	**It is fun**	**It is like therapy**	**It is social**	**Appearance**	**Other**
Year 1	1	13	19	4	2	3	1
Year 3	1	21	7	5	1	2	2

All values describe the number of students who gave affirmative answers.

A total of 9 students answered "no" to the question "are you physically active". Of these, 5 students were categorized "high" and 4 students "moderate" according to IPAQ's categories for physical activity. Reasons for not being physically active varied. Participants answering "no" were significantly more active in the transport section than those who answered "yes" ($p>0.008$).

Participants sitting in vehicle the most were categorized in to IPAQs "high" category. Presented in figure 1. The authors also found that the participants in IPAQs "high" category spend more time sitting than the "Low" and "moderate" categories. Presented in figure 2. There were no significant differences in BMI-values between the "Low", "Moderate" and "High" categories of IPAQ.

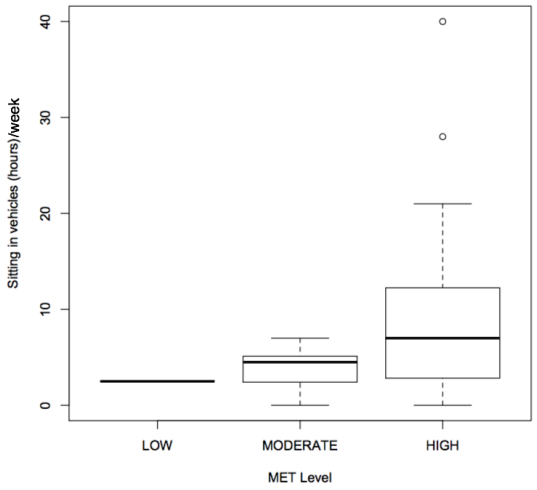

Figure 1. Participants in the IPAQ-category "high" spent most time sitting in vehicle.;

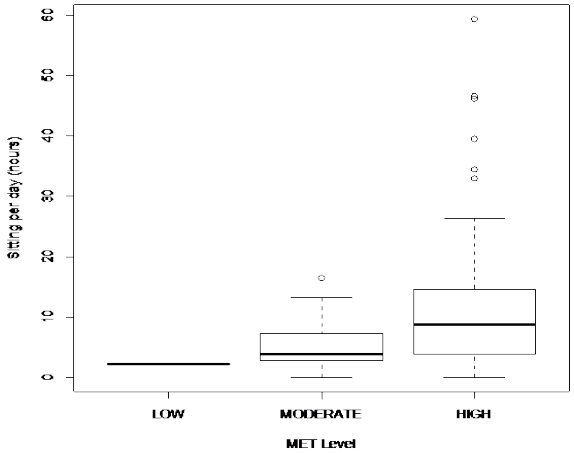

Figure 2. Participants in the IPAQ-category; "high" spent most time sitting/day.

II Comparison between Universities

Section-related physical activity and inactivity

There were no significant differences within the sections (transport, housework, leisure) when comparing Griffith university with the University of Gothenburg. The only significant difference was found in the "work"-section of IPAQ regarding mean MET-minutes/week ($p<0.0001$). The mean value in the work-section was 3094 (SD 4457) MET-minutes/week at Griffith University and the mean value at the University of Gothenburg was 2173 (SD 2492) MET-minutes/week. Details presented in Table 3. No significant differences were found between the universities regarding time spent sitting/day and sitting in vehicle/week. Details presented in Table 4.

Table 3. Illustrates the number of participants being physically active in the specific IPAQ sections ("Work, Transport, Housework and Leisure").

Section	**Work**		**Transport**		**Housework**		**Leisure**	
University	Griffith n=55	Gothenburg n=72	Griffith n=83	Gothenburg n=188	Griffith n=76	Gothenburg n=158	Griffith n=81	Gothenburg n=176
Sex (f/m)	17/38	57/15	31/52	146/42	27/49	125/33	28/53	137/39
Percentage of students (f/m)	60.4 (53.1/64.4)	36.4 (75.3/34.1)	91.2 (96.9/88.1)	94.9 (94.8/95.5)	83.5 (84.4/83.1)	79.8 (81.2/75.0)	89.0 (87.5/89.8)	88.9 (89.0/88.6)
MET-minutes/week#	3094 (SD±4457)	790 (SD±1826)	650 (SD±729)	855 (SD±927)	910 (SD±960)	637 (SD ±1321)	2292 (SD±2947)	1874 (SD ±827)

#mean values include the entire population. both active and inactive for that section.

Table 4. Illustrates time spent sitting per day and sitting in vehicle/week in hours.

Section	**Sitting/day**		**Sitting in vehicle/week**	
University	Griffith n=90	Gothenburg n=198	Griffith n=88	Gothenburg n=196
Sex(f/m)	59/31	154/44	32/56	153/43
Percentage of students (f/m)	98.9 (96.9 / 100)	100 (100 / 100)	96.7 (100 / 94.9)	99.0 (99.4/ 97.7)
Mean hours(f/m)	7.08 (4.92/8.22)	7.2 (7.1/7.4)	7.79(8.38/7.45)	6.9 (7.2/5.9)
Std hours (f/m)	±7.39 (2.84/8.71)	±2.7 (2.5/3.3)	±7.08 (7.31/6.99)	±5.3 (5.6/3.8)
P-value*	P = 0.8405		P = 0.2370	

*=*P-values are from a t-test comparison of average of hours between the universities.*

Main section of the highest MET-minutes/week

At the Griffith University, 41% of the students achieved their highest MET-minutes/week in the work related physical activity section. At the University of Gothenburg, 57,6% of the students achieved their highest MET-minutes/week in the leisure-time related physical activity section. Details presented in Table 5.

Table 5. Illustrates the number of students reaching the highest MET-value(Met-minutes/week) for each IPAQ section.

Main section of METs##	**Griffith University– n(f/m)**	**Percentage**	**University of Gothenburg– n(f/m)**	**Percentage**
Work	37 (12/25)	41 †	23 (19/4)	11.6
Transport	9 (4/5)	10	35 (27/8)	17.7
Housework	11 (4/7)	12	26 (24/2)	13.1
Leisure	33 (12/21)	36 †	114 (84/30)	57.6

† = One participant achieved the exact same MET-minutes/week in both the leisure and work section of IPAQ.

##= The IPAQ-section in which each participant achieved the highest MET-minutes/week.

Total physical activity scores

The values for overall total physical activity MET-minutes per week at both universities are presented in table 6. At Griffith university, the mean value for overall total physical activity (MET-minutes per week) was 6946 (SD 5407). The mean value at the University of Gothenburg was 4162 (SD 3375). There was a significant difference between the two universities ($p<0.0000001$). There were no significant differences between genders at any of the two universities.

Table 6. Overall total physical activity MET-minutes per week.

	Griffith University **n=91**	**University of Gothenburg** **n=198**
Sex(f/m)	32/59	154/44
MET-minutes/week(all)	6946*(SD ±5407)	4162 (SD ±3375)
MET-minutes/week(f)	6740** (SD ±5566)	4023 (SD ±3283)
MET-minutes/week(m)	7058 (SD ±5364)	4648 (SD ±3679)

* p = 0.0000001

** p = 0.000271

Discussion

When comparing data collected at Griffith University to the study conducted at the University of Gothenburg, regarding the IPAQ categories low, moderate and high, no major differences in the student distribution were found.

When comparing the two universities regarding the different sections of IPAQ (work, transportation, housework leisure and time spent sitting), only in the work section a significant difference was noticed, where Griffith University had higher MET-minutes / week. At Griffith

University, participants also achieved their highest MET-minutes / week in the work section and at the University of Gothenburg the participants achieved their highest MET-minutes / week in the leisure time section.

Griffith university had the lowest score in the transportation section, on the subject of highest MET-minutes / week. This indicates that many participants use passive transport. In Australia, nearly 80% of people travel with cars for studies or jobs, making active transportation a very important part of the improvement of public health (31).

The disadvantages of an active transport are described as exposure to environmental hazards, pollution and noise, including heat and traffic accidents. But earlier evidence indicates that the benefits of physical activity weigh it up (32,33,34).

Regarding the cause of physical activity, Griffith University students studying the first year, mostly answered "because it's fun" and student studying their third year mostly answered "because it's healthy". As a result, the authors started to consider whether the education program provides a deeper knowledge and understanding of physical activity. A study from 2007 investigated the effects of a 10-week treatment of lecture/discussion and physical activity on the attitudes of physical activity on community college students. The study found a significant improvement regarding attitudes towards physical activity (35).

The students studying their first year at Griffith University were all at the very beginning of their college program, meaning that they probably had not yet been taught all the benefits of physical activity. Also, the results might have been different if the target population was not health students.

The authors found that all the participants who answered “no” to the question whether they are physically active actually were categorized into the IPAQ criteria “high” and “moderate”. An explanation to this could be an inadequate knowledge about physical activity since the participants had their lowest score at the leisure section, indicating they might believe physical activity in leisure time is all that matters for being physically active.

A meta-analysis of college students’ physical activity behaviours reported that approximately 40-50% of college students are physically inactive. These authors also reported the complexity of comparing physical activity, since there are no standardized measurements for physical activity (36). Simply asking the question “Are you physically active?” might result in false data, since the participants do not exactly know what being physically active actually means. Those who claimed not being physically active achieved most of their MET-minutes / week from the

transportation and work section. Those who answered yes to being physically active had their lowest score at the transportation section and achieved most of their MET-minutes / week from the work and leisure section. Our findings may indicate that the participants believe that it is only during leisure time that physical activity matters. Physical activity should be measured in all activities during the day, not only during leisure time.

The results show that the participants in the category high spend significantly more time sitting per day and sitting in vehicles/week than the low and moderate categories, which strengthens the theory of inadequate knowledge about physical activity. These results also suggest that the participants probably over- and underestimate their number of hours active. Measuring physical activity level by using a questionnaire compared to doubly labelled water has shown that participants have a tendency to mostly overestimate, but sometimes underestimate their physical activity. There have been reported cases as high as 204% overestimation of self-reported hard- and very hard intensity physical activities (37). This could be another reason for the 31 intern lapses of this study. All 31 who were excluded according to IPAQ's scoring protocol (30) had an unreasonably high amount of active time.

Intensity-dependent "MET-minutes / week" can result in misrepresentation of the result, because if the participants are very active for a very short period each day and are inactive (sitting) for the rest of the day, the scores will still be "high". Thus, "MET-minutes per week" only shows how active the participants are at the moment but says nothing about their physical fitness. The current physical guidelines of 150 minutes of physical activity per week represent an amount of approximately 3% of the time we spend awake during an entire week (38). The average time spent sitting per day in Australian adults is almost nine hours a day (39).

When looking at the number of METs for each individual, they are very high, which may be due to the authors targeting health students who might be aware of the benefits of physical activity and are very active overall, perhaps mostly during their leisure time. The risks of sedentary behaviours are known and it is fairly easy to reduce some of these risks. Breaking long periods of sitting with a short period of active time (1 minute and 40 seconds) is more effective than a single continuous break of 30 minutes of physical activity. Although, just standing up, as a break, will not reduce the risks (40).

Our study measures total time spent sedentary and does not investigate anything about breaks. Although the participants in this study spent much time being physically active and have high MET-values / week, they also spent a lot time of time being sedentary.
It is of great importance to inform the public about the consequences of physical inactivity and the NCD diseases that can be prevented with the right type of exercise as well as reaching WHO recommendations. A previous study found that if physical inactivity could be eliminated, the NCD incidence of cardio heart disease, type 2 diabetes, breast cancer would decrease by between 6-10% and in addition, individuals would live longer. (41).

Previous studies used following exclusion criteria; participants should not have been sick, injured or unable to walk without walking aids which prevented the execution of physical activity for the last seven days (27).
These exclusion criteria were not used in this study. The authors wanted a representative picture of reality where people actually are sick and injured which can interfere with their physical activity level. Physical inactivity is harmful regardless of the cause. This may have affected the outcome of the study and if the exclusion criteria from previous studies had been applied, the physical activity level might have been higher for the population.

One reason for not using the short form of IPAQ in this study was due to the fact that the previous study at the University of Gothenburg used the long form of IPAQ (27). Using the short form in this study would then have made the comparison very difficult. Another reason is that the long form is more detailed and investigates the activity level at the four sections; work, transportation, housework and leisure, which the short form does not (30). The long form took approximately 15 minutes to complete. The short form is much shorter and would have taken less time to complete. If the short form would have been used instead, it might have resulted in a higher number of participants. (28).

The authors have chosen to interpret the "IPAQ-scoring protocol" as all cases in which the participants total time variables of; walking, moderate and vigorous is greater than 960 minutes (16 hours), should be excluded from the analysis. All active time has been calculated independently of the number of days of the week. Firstly, the interpretations can time per day or secondly, time as an average per week. Only in the IPAQ section "work" a significant

difference between the first and second interpretations was found, this calculation was conducted at group level (p=0,045). This resulted in the 31 being excluded. If the calculation had been done using average per week, only 13 participants would be excluded.

The authors presence during information, distribution and submission of the questionnaires answering questions contributes to the fact that the absence of physical activity is very important. As an author, it is of great importance, to explain the purpose of the study to the participants and thus increase their interest in participating. Likewise, it is of major importance to make clear that each individual's participation is important in the study's results (42).
Explaining the concept for those who find it difficult to understand written instructions, which, in turn, leads to greater data reliability. Distributing the survey as a google forms link instead of paper copies is environmentally friendly.
Because the questions were mandatory forced-choice questions, some participants may have experienced some of the questions as too personal, troublesome or even annoying. Therefore, the authors explained that the data analysis always will be conducted at group level, and thus it will never be possible to identify any of the individuals.
The risks in this study were negligible compared to most medical research. After all, data is a questionnaire. Students' physical activity/inactivity level is yet a rather unexplored field and this study showed some of their habits. By completing the study questionnaires, the participants agreed to participate in the study.

The distribution of the University of Gothenburg study surveys, took place during winter which could have caused some sources of error, since the possibility of being physically active may be limited by weather conditions. Sweden's climate is colder and the number of sun hours during the year is considerably fewer, compared to Australia, which affects the body's alertness system. The vitamin D in the body decreases in relation to sun hours and this can be expressed in depression, muscle weakness which, in turn, can lead to physical inactivity (43). One likely reason that the University's results did not differ significantly could have been that both countries are industrialized countries.

Since many of the participants have reached the IPAQ category high, one can ask if a survey is the best method for examining physical activity. The survey technique makes the study not

objective and does not give a real value to the participants' activity time, but rather a willingness of what the participants state.

Increasing awareness of physical inactivity and physical activity in clinical patients is an important part of the physiotherapist role. Being able to explain and by use of behaviourism motivate active transport and its positive effects and thus improve an individual's health lies a lot in the physiotherapists hands. An important building block in the physiotherapists work could be asking the similar question to this study; What are the main reasons for being physically active and/or inactive? The exercise programme should be designed for each individual, from which they can receive enjoyment. Discussing this question, can raise an interest about reasons for activity and be used as a key to increase their physical activity, adaptation (i.e. active transportation) and priorities in their everyday life.

Further studies may consider not using IPAQ, since it depends a lot on the participants' self-assessment ability. Another method could be a k-means cluster analysis, which uses relative measurements, not absolute. When computing the student's estimated number of active hours these would be divided by the total number of hours (resulting in the percentage of active hours). The clustering technique takes all questions and participants into account simultaneously, and attempts to find naturally occurring groups. Data is treated as if each question was a mathematical dimension, and in this multidimensional space, natural groups (so-called clusters) where participants with similar answers close to each other (within the groups), are found. Computing data only is one of the advantages of clustering, participants are not divided into categories in advance. Using this method instead, might have given more adequate answers.

Further studies may also investigate how to facilitate physical activity in daily life and the physiotherapists contribution to this. Are physiotherapists in urban planning something we might consider in the future? Examining physical activity and the relationship between the environment and inactivity could also help improve people's possibility of becoming more physically active and reduce sedentary behaviour at no cost to individuals. More parks, bicycle lanes in reduced air pollution areas are examples of environmental adaptations to enhance physical activity (44).

Study limitations

Since age was chosen in intervals, some information gets lost in this study. The relation between age and physical activity would have been interesting to investigate.

Retrospective questions, make it difficult for the participants to remember exactly how active they have been. IPAQ reaches seven days back in time, which is an advantage, since it is easier to remember and estimate activity time over a shorter period of time. However, there is still a risk that the participants' allocated time estimations become misleading (26).

Finally, there are many factors that affect how much activity is exerted in the past seven days. Intensive study periods, personal problems, work, family, psychological factors or traveling, can have a major impact on the participants' time active.

We have chosen the ages 18-25, 26-35, 36-45 and ≥46. The participants are probably in different life stages and also may have different backgrounds, education and views of physical activity, which in turn also can affect results (45).

Another factor that may have affected the results is that the number of participants between the Griffith University and the University of Gothenburg differs and that the University of Gothenburg study included the nursing program and biomedical science instead of the exercise science program.

Conclusion

Students at Griffith University have a high physical activity but spent much time in passive transportation and being sedentary during the day. No major differences between the IPAQ categories "high", "moderate" and "low" was observed when comparing the two universities. Only in the "work" section a significant difference was noticed ($p<0.0001$) when comparing the two universities regarding the different sections of IPAQ. At Griffith University, participants in the category "high" are significantly more inactive and spend more time sitting than the "low" and "moderate" categories, which suggests that participants' ability to estimate the number of hours active is probably over- and underestimated. Examining physical activity and inactivity could help reduce sedentary behaviour by increased self-awareness and increased physical activity knowledge. It is of great importance to inform the public about the consequences of physical inactivity and NCD diseases, which can be prevented with the right type of exercise as well as reaching the WHO recommendations.

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Appendix

Appendix 1

Hi! We, Annika Holmqvist and Niklas Lindqvist, are two Physiotherapist students from Sweden, studying our final year at the University of Gothenburg. We are writing our bachelor thesis which aims to investigate and describe the physical activity level of health-students at Griffith University, in Australia. By completing the forms, you agree to participate in the study and help us complete our project, estimated time is approximately 10 minutes.

Background and purpose

Physical inactivity and sedentary behavior is increasing in today's society and leads to premature death due to illness. The purpose of this work is to investigate and describe the physical activity level of health-students at Griffith University, in Australia. This will then be compared with a previous study conducted in health-students at the University of Gothenburg.

Request for participation

You are asked to participate in a questionnaire study which investigates and draws attention to amount of physical activity among health students, such as physiotherapy, exercise science and nursing. If you do not want to participate, please hand in the forms blank.

The study's approach and data management
It is voluntary to answering either our Google Link-forms or handouts and all information will be reported anonymously.
The data analysis will be conducted at group level; thus it is never possible to identify the individuals. All material will be destroyed after the end of the study.

What are the benefits of the study or are there risks by participating?
Students spend a lot of their every day time studying, which usually means many hours spent sitting per day. The expectation is that the results of the study will help mapping the physical activity and inactivity habits of health students. Differences and similarities between the two geographically very different countries can provide an interesting insight, since climate, construction of society and infrastructure can differ widely.

The authors consider no risks of participating in the study. Some questions regarding health may be perceived as sensitive, but since participation is voluntary and anonymous, this is considered a very small risk.

How do I get information about the results of the study?
The results will be presented at the University of Gothenburg and if you wish to take part of the completed thesis, you are welcome to e-mail either of us (mail addresses below).

Compensation
No compensation will be paid to the participants in this study.

Responsible
Responsible for the project are Annika Holmqvist and Niklas Lindqvist, physiotherapist students at the University of Gothenburg. Supervisor is Eva Holmgren (email: eva.holmgren@neuro.gu.se), Reg. Physiotherapist, senior lecturer, PhD.
If you have questions, contact: Annika Holmqvist, gusholmqan@student.gu.se or Niklas Lindqvist, guslinnie@student.gu.se

Appendix 2

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE (October 2002)

LONG LAST 7 DAYS SELF-ADMINISTERED FORMAT

FOR USE WITH YOUNG AND MIDDLE-AGED ADULTS (15-69 years)

The International Physical Activity Questionnaires (IPAQ) comprises a set of 4 questionnaires. Long (5 activity domains asked independently) and short (4 generic items) versions for use by either telephone or self-administered methods are available. The purpose of the questionnaires is to provide common instruments that can be used to obtain internationally comparable data on health–related physical activity.

Background on IPAQ

The development of an international measure for physical activity commenced in Geneva in 1998 and was followed by extensive reliability and validity testing undertaken across 12 countries (14 sites) during 2000. The final results suggest that these measures have acceptable measurement properties for use in many settings and in different languages, and are suitable for national population-based prevalence studies of participation in physical activity.

Using IPAQ

Use of the IPAQ instruments for monitoring and research purposes is encouraged. It is recommended that no changes be made to the order or wording of the questions as this will affect the psychometric properties of the instruments.

Translation from English and Cultural Adaptation

Translation from English is encouraged to facilitate worldwide use of IPAQ. Information on the availability of IPAQ in different languages can be obtained at www.ipaq.ki.se. If a new translation is undertaken we highly recommend using the prescribed back translation methods available on the IPAQ website. If possible please consider making your translated version of IPAQ available to others by contributing it to the IPAQ website. Further details on translation and cultural adaptation can be downloaded from the website.

Further Developments of IPAQ

International collaboration on IPAQ is on-going and an ***International Physical Activity Prevalence Study*** is in progress. For further information see the IPAQ website.

More Information

More detailed information on the IPAQ process and the research methods used in the development of IPAQ instruments is available at www.ipaq.ki.se and Booth, M.L. (2000). *Assessment of Physical Activity: An International Perspective.* Research Quarterly for Exercise and Sport, 71 (2): s114-20. Other scientific publications and presentations on the use of IPAQ are summarized on the website.

INTERNATIONAL PHYSICAL ACTIVITY QUESTIONNAIRE

We are interested in finding out about the kinds of physical activities that people do as part of their everyday lives. The questions will ask you about the time you spent being physically active in the **last 7 days**. Please answer each question even if you do not consider yourself to be an active person. Please think about the activities you do at work, as part of your house and yard work, to get from place to place, and in your spare time for recreation, exercise or sport.

Think about all the **vigorous** and **moderate** activities that you did in the **last 7 days**. **Vigorous** physical activities refer to activities that take hard physical effort and make you breathe much harder than normal. **Moderate** activities refer to activities that take moderate physical effort and make you breathe somewhat harder than normal.

PART 1: JOB-RELATED PHYSICAL ACTIVITY

The first section is about your work. This includes paid jobs, farming, volunteer work, course work, and any other unpaid work that you did outside your home. Do not include unpaid work you might do around your home, like housework, yard work, general maintenance, and caring for your family. These are asked in Part 3.

1. Do you currently have a job or do any unpaid work outside your home?

Yes ☐

☐

No → *Skip to PART 2: TRANSPORTATION*

The next questions are about all the physical activity you did in the **last 7 days** as part of your paid or unpaid work. This does not include traveling to and from work.

2. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, digging, heavy construction, or climbing up stairs **as part of your work**? Think about only those physical activities that you did for at least 10 minutes at a time.

_____ days per week

☐ No vigorous job-related physical activity → ***Skip to question 4***

3. How much time did you usually spend on one of those days doing **vigorous** physical activities as part of your work?

_____ hours per day _____ minutes per day

4. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like carrying light loads **as part of your work**? Please do not include walking.

_____ days per week

☐ No moderate job-related physical activity → ***Skip to question 6***

5. How much time did you usually spend on one of those days doing **moderate** physical activities as part of your work?

_____ hours per day _____ minutes per day

6. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **as part of your work**? Please do not count any walking you did to travel to or from work.

_____ days per week

☐ No job-related walking → **Skip to PART 2: TRANSPORTATION**

7. How much time did you usually spend on one of those days **walking** as part of your work?

_____ **hours per day** _____ **minutes per day**

PART 2: TRANSPORTATION PHYSICAL ACTIVITY

These questions are about how you traveled from place to place, including to places like work, stores, movies, and so on.

8. During the **last 7 days**, on how many days did you **travel in a motor vehicle** like a train, bus, car, or tram?

_____ days per week

☐ No traveling in a motor vehicle → ***Skip to question 10***

9. How much time did you usually spend on one of those days **traveling** in a train, bus, car, tram, or other kind of motor vehicle?

_____ hours per day _____ minutes per day

Now think only about the **bicycling** and **walking** you might have done to travel to and from work, to do errands, or to go from place to place.

10. During the **last 7 days**, on how many days did you **bicycle** for at least 10 minutes at a time to go **from place to place**?

_____ days per week

☐ No bicycling from place to place → ***Skip to question 12***

11. How much time did you usually spend on one of those days to **bicycle** from place to place?

_____ hours per day _____ minutes per day

12. During the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time to go **from place to place**?

_____ days per week

☐ No walking from place to place → ***Skip to PART 3: HOUSEWORK,***

HOUSE MAINTENANCE, AND CARING FOR FAMILY

13. How much time did you usually spend on one of those days **walking** from place to place?

_____ **hours per day** _____ **minutes per day**

PART 3: HOUSEWORK, HOUSE MAINTENANCE, AND CARING FOR FAMILY

This section is about some of the physical activities you might have done in the **last 7 days** in and around your home, like housework, gardening, yard work, general maintenance work, and caring for your family.

14. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like heavy lifting, chopping wood, shoveling snow, or digging **in the garden or yard**?

_____ days per week

☐ No vigorous activity in garden or yard → ***Skip to question 16***

15. How much time did you usually spend on one of those days doing **vigorous** physical activities in the garden or yard?

_____ hours per day _____ minutes per day

16. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, sweeping, washing windows, and raking **in the garden or yard**?

_____ days per week

☐ No moderate activity in garden or yard → ***Skip to question 18***

17. How much time did you usually spend on one of those days doing **moderate** physical activities in the garden or yard?

_____ hours per day _____ minutes per day

18. Once again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** activities like carrying light loads, washing windows, scrubbing floors and sweeping **inside your home**?

_____ days per week

☐ No moderate activity inside home → ***Skip to PART 4: RECREATION,***

SPORT AND LEISURE-TIME PHYSICAL ACTIVITY

19. How much time did you usually spend on one of those days doing **moderate** physical activities inside your home?

_____ **hours per day** _____ **minutes per day**

PART 4: RECREATION, SPORT, AND LEISURE-TIME PHYSICAL ACTIVITY

This section is about all the physical activities that you did in the **last 7 days** solely for recreation, sport, exercise or leisure. Please do not include any activities you have already mentioned.

20. Not counting any walking you have already mentioned, during the **last 7 days**, on how many days did you **walk** for at least 10 minutes at a time **in your leisure time**?

_____ days per week

☐ No walking in leisure time → ***Skip to question 22***

21. How much time did you usually spend on one of those days **walking** in your leisure time?

_____ hours per day _____ minutes per day

22. Think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **vigorous** physical activities like aerobics, running, fast bicycling, or fast swimming **in your leisure time**?

_____ days per week

☐ No vigorous activity in leisure time → ***Skip to question 24***

23. How much time did you usually spend on one of those days doing **vigorous** physical activities in your leisure time?

_____ hours per day _____ minutes per day

24. Again, think about only those physical activities that you did for at least 10 minutes at a time. During the **last 7 days**, on how many days did you do **moderate** physical activities like bicycling at a regular pace, swimming at a regular pace, and doubles tennis **in your leisure time**?

_____ days per week

☐ No moderate activity in leisure time → ***Skip to PART 5: TIME SPENT SITTING***

25. How much time did you usually spend on one of those days doing **moderate** physical activities in your leisure time?

_____ **hours per day** _____ **minutes per day**

PART 5: TIME SPENT SITTING

The last questions are about the time you spend sitting while at work, at home, while doing course work and during leisure time. This may include time spent sitting at a desk, visiting friends, reading or sitting or lying down to watch television. Do not include any time spent sitting in a motor vehicle that you have already told me about.

26. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekday**?

_____ hours per day _____ minutes per day

27. During the **last 7 days**, how much time did you usually spend **sitting** on a **weekend day**?

_____ hours per day _____ minutes per day

This is the end of the questionnaire, thank you for participating.

Appendix 3

Complementary questions

1. Which gender are you?	Female Male
2. How old are you?	18-25 26-35 36-45 ≥46
3. How tall are you? In cm	_____cm
4. How much do you weigh? In kg	_____kg
5. Which program are you in?	Exercise science Physiotherapy
6. Are you physically active?	Yes No

(Yes: A minimum of 30 minutes moderate-intensity 5 days/week OR 20 minutes vigorous intensity 3 days/week OR a combination of both alternatives.)

If **Yes** fill in question 7, 8, 9 and 10 skip question number 11.
If **No** go directly to question number 11.

7. Why are you physically active? *Choose one alternative.*	Because I have to It is healthy It is fun It is like therapy It is social To have a good appearance Other
8. What is your main type of physical activity? *Choose one alternative.*	Dancing Gym/group training Martial Art Swimming/running/cycling/surfing Team sport Walking Other physical activities
9. If you choose team sport, which ones?	_____
10. If you choose other physical activities, which ones?	_____

11. Why are you physically inactive?
Choose one alternative.

I have no time
I do not enjoy it
I have no access to a sport facility
Incapability
Injury
It is too expensive
Other